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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/536,706	01/03/2006	Stewart E. Hooper	YAMAP0983US	9271

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EXAMINER	
MALEKZADEH, SEYED MASOUD	
ART UNIT	**PAPER NUMBER**
1791	
MAIL DATE	**DELIVERY MODE**
01/04/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/536,706	HOOPER ET AL.	
	Examiner	Art Unit	
	SEYED M MALEKZADEH	1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 December 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6 and 8-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6 and 8-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 May 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

In view of the amendments after final and applicants' arguments filed on 12/05/2007, PROSECUTION IS HEREBY REOPENED. A new ground of rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) File a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) initiate a new appeal by filing a notice of appeal under 37 CFR 41.31 followed by an appeal brief under 37 CFR 41.37. The previously paid notice of appeal fee and appeal brief fee can be applied to the new appeal. If, however, the appeal fees set forth in 37 CFR 41.20 have been increased since they were previously paid, then appellant must pay the difference between the increased fees and the amount previously paid.

A Supervisory Patent Examiner (SPE) has approved of reopening prosecution by signing below:

Yogendra N. Gupta
Supervisory Patent Examiner

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 22-23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite in that it fails to point out what is included or excluded by the claim language. This claim is an omnibus type claim.

Claim 22 is claiming an apparatus which includes limitations of a method which being indefinite in that it fails to point out what is included or excluded by the claim language.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 21-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Keller et al. (US 5,891,790)

claims 21-22 are drawn to a product which is obtained by the process and therefore will be treated as required via MPEP 2113 [R-1].

> "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." (MPEP 2113[R-1])

As to claim 21, Keller et al. ('790) teaches a p-type nitride semiconductor material (See lines 6-8 and 49-54, column 2). Further as to claim 22, Keller et al. ('790) teaches a semiconductor device comprising a layer of a p-type nitride semiconductor material, (See lines 36-42, column 1 and lines 6-8 and 49-54, column 2), as claimed in claim 22.

The prior art, thus meets all the claim limitations, and therefore Keller et al. ('790) anticipates claims 21-22.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-6, 8-12, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Keller et al (US 5,891,790).

As to claim 1, Keller et al. (US 5,891,790) teaches P-type Gallium Nitride (GaN) films which are being grown using a variety of growth techniques such as Molecular Beam Epitaxy (MBE). Keller et al ('790) further teaches in a preferred embodiment cyclopentadienyl magnesium CP_2Mg is supplied to dope the gallium nitride as a p-type nitride material with the magnesium. (See 63-67, column 3)

As to claim 2, Keller et al. ('790) further teach aluminum as a dopant for p-type gallium nitride (See lines 56-61, column 3). Therefore, prior art is suggesting by doping of p-type gallium nitride by aluminum, and would be expected to produce a p-type (Ga, Al) N, as claimed in claim 2.

As to claims 3 and 4, Keller et al. ('790) teach supplying of ammonia gas (see lines 19-26 column 2), gallium (See lines 1-15, column 4) and CP_2Mg (See lines 56-67, column 3) to a growth chamber, to grow a layer of p-type GaN. (See lines 1-26, column 6)

As to claim 5, Keller et al. ('790) disclose supplying of ammonia gas (see lines 19-26 column 2), gallium (See lines 1-15, column 4), CP_2Mg (See lines 56-67, column 3), and Aluminum (See lines 59-62, column 3) to a growth chamber in which is expected to grow a layer of p-type AlGaN.

As to claim 6, Keller et al. ('790) teaches elemental nitrogen containing gas (58) is supplied to the gas line (24) through mass flow controller (60) and the flow of elemental nitrogen containing gas (58) is controlled by valve (62) wherein elemental nitrogen containing gas is typically ammonia, but can be other materials also. (See lines 46-50, column 3 and lines 1-

15, column 4) As suggested by the prior art, elemental nitrogen containing gas is capable of containing different materials and its flow rate is controlled by mass flow controller during supply of the gas to growth chamber, and thus clearly suggest a control supply of material in the chamber including CP_2Mg.

As to claims 8-12, Keller et al. (790) also teach the growth process is carried out at a temperature of between 800 °C to 1100 °C, but can be higher or lower which clearly suggest the growth process is carried out at a temperature of between 800° C to 960° C. (See lines 12-15, column 3)

Claim 23 is drawn to a product, and Keller et al. ('790) clearly teaches p-type GaN films as a semiconductor device which is doped with aluminum. (See lines 61-67, column 2) Therefore, prior art suggests a GaN film which is doped with aluminum and the product would be expected to be p-type (Ga, Al)N product layer.

As discussed above, Keller et al. ('790) suggests growing P-type Gallium Nitride (GaN) films using various growth techniques such as Molecular Beam Epitaxy (MBE) and metal-organic chemical vapor deposition (MOCVD).

However, Prior art is silent about supplying cyclopentadienyl magnesium (CP_2Mg) during the p-type nitride growth by molecular beam epitaxy (MBE) method, but clearly suggests the use of MBE for the claimed process. Therefore, it would have been obvious for one of ordinary skill in the art at the time of applicant's invention to merely use MBE as a method for growing a p-type nitride semiconductor material because MBE has similar process functionality with other growth techniques such as metal-organic chemical vapor deposition (MOCVD), and would be expected to function similarly for growing a p-type nitride semiconductor material.

Claims 13-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Keller et al (US 5,891,790) in view of Barnes et al. (US 2004/0214412).

Keller et al ('790) teaches all the claim limitations of a method for growing a P-type nitride semiconductor material by Molecular Beam Epitaxy process as discussed above in the rejection. Further Keller et al ('790) teaches about the CP_2Mg pressure in the process. (See lines 29-45, column 3)

However, Keller et al (790) does not teach the claimed degree of pressure for supplied CP_2Mg, also does not teach the claimed degree of pressure for supplied elemental gallium during GaN growth process.

In the analogous art, Barnes et al. ('412) teaches a method of growing a P-type nitride semiconductor material by molecular beam epitaxy wherein magnesium is used as a P-type dopant. Barnes et al. ('412) further discloses Magnesium may be supplied to the growth chamber at a beam equivalent pressure of less than $1\times10^{-7}mbar$. (Paragraph 15). CP_2Mg is a Magnesium source to dope nitride material during growing a P-type nitride semiconductor. Also Barnes et al. discloses Gallium is supplied to the growth chamber of molecular beam epitaxy at a beam equivalent pressure greater than $1\times10^{-8}mbar$ and less than $1\times10^{-5}mbar$.

It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to modify Keller et al ('790) by providing a supplying pressure of less than $1\times10^{-7}mbar$ for CP_2Mg, and providing a supplying pressure of greater than $1\times10^{-8}mbar$ and less than $1\times10^{-5}mbar$ for elemental gallium during GaN growth process in order to provide a p-type GaN that has a

high concentration of free charge carriers and eliminates the need to activate magnesium dopant atoms or gallium atoms by annealing or irradiating the material, as suggested by Barnes et al. ('412).

Claims 19 and 20 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Keller et al (US 5,891,790) in view of Hooper et al. (US 2002/0117103).

Keller et al ('790) teaches all the claim limitations of a method for growing a P-type nitride semiconductor material by Molecular Beam Epitaxy process as discussed above. Further Keller et al ('790) teaches about the CP_2Mg pressure in the process. (See lines 17-45, column 3). Further Keller et al teaches the functional equivalency of Indium and aluminum (See lines 56-62, column 3). Therefore the degree of pressure for supplied elemental Ga and In in InGaN growth process is comparable to the degree of pressure for supplied elemental Ga and Al in AlGaN growth process.

However, Keller et al does not teach the claimed degree of pressure supplied for elemental gallium and elemental aluminum during AlGaN growth process.

In the analogous art, Hooper et al (2002/0117103) teaches a method of growing an (In, Ga)N layer structure by molecular beam epitaxy. Hooper et al ('103) further teaches the beam equivalent pressure of indium and gallium supplied to the growth chamber may be equal to or greater than $1\times10^{-8}mbar$ and less than $1\times10^{-4}mbar$. (See paragraphs [0027] and [0028]).

It would have been obvious to one of ordinary skill in the art at the time of applicant's invention to modify method of Keller ('790) by providing a supplying pressure of less than $1\times10^{-8}mbar$ for elemental gallium and elemental aluminum during AlGaN growth process in order to prevent from low growth rate of nitride layer and obtaining a high-quality growth of the layers, as suggested by Hooper et al. ('103).

Response to Arguments

Applicant's arguments with respect to claims 1-6 and 8-23 have been fully considered but are moot in view of the new ground(s) of rejection.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Seyed Masoud Malekzadeh whose telephone number is 571-272-6215. The examiner can normally be reached on Monday - Friday at 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra N. Gupta can be reached on (571) 272-1316. The fax number for the organization where this application or proceeding is assigned is 571-272-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published application may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance form a USPTO Customer Service Representative or

access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SMM

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